

1.) Let  $A = \begin{pmatrix} 9e^x & e^x \\ e^x & e^{3x} \end{pmatrix}$ .

(a) Find an expression for  $\det A$ .

(2)

(b) Find the value of  $x$  for which  $A$  has no inverse. Express your answer in the form  $a \ln b$ , where  $a, b \in \mathbb{Z}$ .

(5)

(Total 7 marks)

2.) Let  $M = \begin{pmatrix} 2 & 1 \\ 2 & -1 \end{pmatrix}$ .

(a) Write down the determinant of  $M$ .

(1)

(b) Write down  $M^{-1}$ .

(2)

(c) Hence solve  $M \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$ .

(3)

(Total 6 marks)

3.) Let  $A = \begin{pmatrix} 1 & -1 & 3 \\ 2 & 1 & 1 \\ 0 & 2 & -2 \end{pmatrix}$ .

(a) Write down  $A^{-1}$ .

(2)

The matrix  $B$  satisfies the equation  $\left(I - \frac{1}{2}B\right)^{-1} = A$ , where  $I$  is the  $3 \times 3$  identity matrix.

(b) (i) Show that  $B = -2(A^{-1} - I)$ .

(ii) Find  $B$ .

(iii) Write down  $\det B$ .

(iv) Hence, explain why  $B^{-1}$  exists.

(6)

Let  $BX = C$ , where  $X = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$  and  $C = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix}$ .

(c) (i) Find  $X$ .

(ii) Write down a system of equations whose solution is represented by  $X$ .

(5)

(Total 13 marks)

4.) Let  $A = \begin{pmatrix} 3 & 2 \\ k & 4 \end{pmatrix}$  and  $B = \begin{pmatrix} 2 & 2 \\ 1 & 3 \end{pmatrix}$ . Find, in terms of  $k$ ,

(a)  $2A - B$ ;

(b)  $\det(2A - B)$ .

(Total 6 marks)

5.) If  $A = \begin{pmatrix} 2p & 3 \\ -4p & p \end{pmatrix}$  and  $\det A = 14$ , find the possible values of  $p$ .

*Working:*

*Answer:*

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(Total 4 marks)